



TREATMENT OF ANEURISM: ADVANTAGES OF COMPLETELY ARRESTING THE CURRENT THROUGH THE SAC.*

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THE treatment of external aneurisms by compression, one of the greatest of modern surgical improvements, was established by Dublin surgeons. They advocated such a degree of compression as would send the blood gently flowing through the sac; layer after layer of coagula being expected to form, as happens, it was asserted, when aneurisms cure spontaneously. Arrest of current, and clotting of the blood in the sac, were deprecated; but it seems to me that the following cases show that these events are, on the contrary, most desirable.

CASE I.—J. D., aged 25, healthy, was admitted into St. Vincent's Hospital January 14th, 1865, for right ilio-femoral aneurism, which had begun without injury five months before. Digital and partial instrumental pressure having failed, I tried to stop the common iliac with an elastic compressor, the patient being kept under chloroform for twelve hours. No clot formed. An anthracoid slough formed at the point of pressure.

Five days afterwards, another attempt was made, after the following preparatory steps. The abdomen was made lank by emptying the bowels and bladder; the limb was raised, bandaged and fixed to aid venous return, and to render increased flow of blood for muscular action unnecessary; and the sac was compressed by an elastic roller, so as to contract the space to be filled by the clot as much as possible. At Dr. O'Ferrall's suggestion, the superficial femoral was stopped, so as to keep the sac full. Signoroni's clamp was then fixed over the common iliac artery for four and a half hours, when the tumour was found solid and pulseless, the common and external iliacs being still pervious. Absorption and complete cure followed.

CASE II.—J. B., aged 35, healthy, was admitted into St. Vincent's Hospital, May 1866, for left popliteal aneurism, which followed a strain a fortnight before, while getting down from his cab. The sac was as large as a turkey-egg, and towards the biceps appeared diffuse. Digital and elastic instrumental pressure failing, stoppage as complete as could be achieved in a very restless patient was kept up for five hours, when the sac was found pulseless. Thirty-six hours afterwards, pulsation recommenced. After three other attempts, unsuccessful because chloroform was refused, the femoral at Scarpa's triangle was compressed, and the flow of blood out of the sac was impeded by tight bandaging and elevation of the leg, distal pressure on the popliteal not being possible. The patient was kept apathetic, not insensible, with chloroform, for nine and a half hours, when the sac was found hard and

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pulseless. At the compressed point, a superficial slough formed; but, with this exception, the recovery was rapid and perfect.

In both cases, bromide of potassium internally, and ice locally, gave aid by lowering the circulatory force. A good meat diet was given, to increase the plasticity of the blood; but drink was not restricted, for it is unphysiological to suppose that thus we can thicken that fluid. Fresh vegetable food augments the plasticity of the blood in scurvy, and may be reasonably allowed in the diet of a patient with aneurism.

Pain has been the great obstructive to partial compression; and complete pressure would be unendurable without chloroform, that inestimable boon, which we owe to the genius of Simpson. By acupressure, also, that philosopher has enabled us to treat cases such as the innominate aneurism now under Mr. Porter's care, in which compression was inapplicable, and ligature would be mortal. Chloroform darkens blood, but does not lessen its coagulability.

Distal pressure should precede and accompany proximal pressure; for thus the sac is kept full of blood at rest, and the resulting clot will equal its cavity. During the many hours which elapse before the separation of clot and serum is complete, the sac will probably contract on the clot, while the serum oozes away or is absorbed. In popliteal or antecubital cases, distal pressure being impracticable, Mr. Hart's flexion plan may achieve the same object. I doubt that an aneurism has ever been cured by such pressure as would only lessen the calibre of the artery leading to the sac; for then the flow of blood being quickened, and the efferent vessel being larger, the blood would not remain long enough to clot. The blood flowing in would carry the agent to which the fluidity of fibrine is due; but, if the blood in the sac be isolated, this volatile agent may permeate its coats. In cases said to be cured by partial compression, it is probable that, the pressure having been increased to the amount of complete arrest for a short time, clotting in the sac, or plugging of the artery below it, produced the cure; for the pulsation is usually reported to have suddenly ceased. Digital pressure has of late been most successful, because it is usually employed to the degree of complete arrest. The evidence to prove that, in cases cured by partial compression, the sac is filled by laminated fibrine, is most insufficient; and, in fusiform aneurisms or sacculated aneurisms freely opening into the ruptured artery, it is impossible to conceive such an occurrence. In the fifty-three cases cured by compression, and detailed in the *Nouveau Dictionnaire de Médecine et de Chirurgie*, nine solidified under twelve hours, and four under four hours, in which time this much talked of stratification could not have been accomplished.

A few hours (perhaps less than an hour, as in Dr. Murray's aortic case) suffice to clot the blood isolated in the sac; while cure by partial compression takes, on the average, twenty-five days. One believer in the method persevered in its use for nine months. The anxiety and confinement probably lessen the coagulability of the blood; and it has only succeeded in 62 per cent. of the cases in which it was tried. Complete pressure has succeeded in at least four cases; and I am not aware that it has ever failed. With two pressing points, and as soon as experience reduces the time of pressure to a minimum, sloughing need not be feared. In conclusion, I claim for this method greater rapidity and greater certainty than partial compression, and far greater safety than deligation.

NOTES ON THE RAPID PRESSURE TREATMENT OF ANEURISM.*

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THE object of this paper is to prove, first, that aneurisms of the largest size can be treated successfully by a process which is so rapid in its operation as to occupy less than an hour; and, second, that the cure takes place in these cases by coagulation of blood in the sac of the aneurism, and not, as has been hitherto believed, by the deposition of fibrine.

What is the nature of this treatment? The patient is put fully under the influence of chloroform, that we may be enabled to apply a very powerful pressing instrument on tender or sensitive parts, such as the site of the abdominal aorta. The full administration of chloroform is further necessary to relax the muscular system, which is an important condition of success, as the slightest movement of the pressing instrument by the muscular action of the parts pressed on, is fatal to this process of cure. I would draw special attention to the next part of the treatment, as success is dependent upon the care with which this is carried out. *It is the complete arrest of all movement of the blood in the aneurismal sac.* By the old method of cure, fibrine was supposed to coagulate and be deposited from the very slow, scanty, and feeble current of blood, which found its way through the sac of the aneurism while incomplete pressure was maintained. Such a current, however feeble and slow, would be absolutely fatal to the rapid treatment. Complete arrest, therefore, of a current of blood, which shall be retained in a motionless state, is the secret of success. In fact, you must do by pressure exactly what is done by the ligature when it is applied to the artery above the aneurism; and you may do even more than is done by the ligature; for Dr. O'Ferrall of Dublin has insisted upon the application of distal as well as proximal pressure; and Dr. Mapother has carried out his suggestion with complete success. Aneurisms requiring pressure on the abdominal aorta are perhaps least dependent on distal pressure, as the collateral circulation to the lower parts of the body is here so limited as to render a current into the distal orifice of the aneurism improbable. In order to obtain this complete arrest of blood in the sac of the aneurism, the most careful and energetic watching of the pressing instrument is necessary. You must have so deep an interest in the treatment that you will sit for a whole hour or more, enduring the most trying strain on your muscular and nervous systems, before you can hope to obtain a cure. Your eye and hand must be continually testing the condition of the aneurismal swelling; and the faintest indication of pulsation there must be considered fatal to the process of cure, and at once remedied; in fact, the tourniquet must be so placed as not to permit a single rush of blood into the aneurism. Nothing short of this will bring about a cure in a short space of time.

We must now consider the duration of the treatment. At Newcastle, a case of aneurism of the abdominal aorta underwent the process of cure in three-quarters of an hour; and, in another case at Sunderland, under Dr. Heath's care, consolidation was distinctly observed to occur within twenty minutes. In the Newcastle case, unsuccessful efforts had been made for four hours; and, at the end of that time, the aneurism re-

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mained unchanged. As neither increase of solidity, diminished pulsation, nor decrease in size, could be detected, I determined to make a final effort. The patient being fully under the influence of chloroform, I re-applied the tourniquet, and held it firmly and securely over the aorta so as to obliterate every trace of pulsation. By a prolonged effort, three-fourths of an hour passed without a single slip of the instrument. It was then removed, and the aneurism had ceased to pulsate. A slight movement was perceptible for some time afterwards; this being an impulse communicated from the pulsation of the aorta above it.

In Dr. Heath's case, the pressure had been kept up irregularly for about ten hours, when the patient fainted under the chloroform. The pressure was then removed, and the pulsation and other characters of the aneurism were found to be as bad as ever. The patient was then urged to bear a final attempt without chloroform. This he did; and, to our amazement, when, at the end of twenty minutes, he declared he could bear the pressure no longer, we found the aneurism had become solid and had ceased to beat.

Here, then, are two cases in which the actual process of cure was brought about in less than an hour. How is this effected? We affirm by coagulation of blood in the sac of the aneurism. We believe this, because of the short time occupied in bringing about a sudden and decided change in the disease. It seems to me impossible that fibrine can be so rapidly deposited from the blood in such quantities as to fill up the cavity of a large aneurism, and to change a pulsating, thrilling, and expanding sac, into a motionless solid mass. This opinion is supported by another important fact—the large soft mass which is produced by the filling of the aneurism with solid matter disappears in a few hours. In each of the above cases, all trace of the aneurismal tumour was gone before we could obtain a plaster cast of the part. Rapidity of disappearance, then, as well as rapidity of production, is in favour of the existence of coagulation of the blood. In it we have contraction of a clot of blood inside the aneurism, by which the watery parts of the blood are squeezed out and absorbed, such as occurs in a clot of blood outside the body.

In conclusion, we may observe that the solution of fibrine in liquor sanguinis is, like all complicated natural phenomena, to be regarded as resulting from the adjustment of certain conditions to the forces by which it is maintained. When we disturb the conditions, the phenomenon ceases, to be replaced by another equally remarkable—coagulation. In fact, by substituting the conditions of coagulation for those of the solution of fibrine we cure aneurism. The day may come when even a simpler plan than pressure will effect this change; but, at present, it must be admitted that a great advance has been made in limiting the time and altering the process by which this disease may be cured.

Discussion on the Papers of Dr. Mapother and Dr. Murray.

Mr. COLLIS: I should apologise for speaking so soon after having just spoken. Dr. Mapother was kind enough to let me see his first case, which had for me a peculiar interest; with the same clamp of Signoroni, which effected a cure in it, I had the good fortune to effect a cure in a most interesting case. It is on record in the *Dublin Quarterly Journal*, so I need only indicate it. It was a case of aneurism of the common femoral artery, close to Poupart's ligament, leaving scarcely the breadth of a finger for compression. Digital pressure was tried for two or three days without any effect on the tumour, and with the disadvantageous effect of producing a tendency to slough in the integuments.

Prior to tying the common iliac artery, which I was prepared to do, I put on Signoroni's clamp, the same as I had the pleasure to lend Dr. Mapother. I put it upon the artery and made adequate pressure with it, so as completely to cut off all current through the femoral artery. That did very well as long as the clamp remained in the proper situation; but the slightest movement of the patient sent it up on the abdomen, and I was beginning to despair of curing the aneurism by compression, when it occurred to me to screw the clamp well down and tie it down to the knee. I did so with the desired effect. In twenty-eight hours the aneurism was completely consolidated, and the man returned to his work in the course of about three weeks. I saw him a few months afterwards, and the sac was completely atrophied, and years afterwards he remained perfectly well.

Mr. ERNEST HART: Having given a considerable amount of attention both to the history and the treatment of aneurism, I feel convinced, from a study of the cases recorded since the pressure treatment was first inaugurated in Dublin—recorded here and in every part of the world—that this method of rapid cure by complete compression is destined to be generally adopted as the mode of treatment *par excellence* for surgical aneurism. This treatment is almost as great an improvement on the slow method of compression as compression itself was upon the method of ligature. A study of the slow method—of the cases of treatment of aneurism by the tourniquet—will always show, when the history is carefully observed, that the cure has been effected suddenly. The progress goes on apparently during a great number of days; but in nearly all the cases, when the clinical history is complete, there has been a sudden cure. The patient himself is conscious of the moment at which the circulation has been completely arrested within the aneurism, and is thus informed by his own sensations of the moment at which the cure is effected. In Dr. Bellingham's valuable work on the subject, he treats of the reasons of failure of the efforts of earlier surgeons to effect a cure of aneurism by complete and continuous arterial compression, for this is a recurrence to the earlier doctrines in the treatment of aneurism. Freer laid down that aneurism is to be treated by a complete arrest of the flow of blood, or rather by a coagulation of the blood within the sac; and Bellingham shewed that the proceeding failed by the extreme pain that it caused. From observation of *post mortem* preparations, finding that in cases of slow cure there was lamination of fibrine, it was concluded that slow deposition of laminated fibrine was a pathological necessity. However, although a pathological incident in the cure, it is by no means necessary; and it seems clear that, by the introduction of the application of chloroform to the treatment of aneurism, there is the greatest reason to hope that aneurism may be cured in as many hours, perhaps as many minutes, as formerly days and weeks were occupied. There are several cases on record in which precisely this method of cure was effectually applied without chloroform, where the patients had the courage to endure it. There are cases where a complete arrest was effected in this manner by American surgeons. In one of them a rather rough appliance was used. A tall rod was fixed in the ceiling, its end impinging on the artery; the patient was fixed down in his bed, and could not move; the arrest of the blood was complete, and the aneurism was cured in an hour and a-half; but it was an hour and a-half of extreme agony.

Dr. GEOGHEGAN: It is specially satisfactory to find that the true principle to be adopted in the treatment of aneurism by compression seems to have been at last called forth; and therefore we must hail the papers of to-day as of particular importance, bearing as they do upon that principle. I was one of the most intimate friends of the late

Dr. Bellingham, a surgeon of many years' standing in this city, and I have seen nearly all his cases treated by compression; and during a long series of years I strenuously contended against the principle maintained by him that the mode of curing aneurism consisted in the mere diminution of the current of blood flowing through the sac, and the production of laminated fibrine in. For a long time the circumstance was totally disregarded, that in numerous cases of aneurism not treated by compression at all this laminated fibrine is constantly deposited. In the writers of the old Italian and French schools it is never suggested that any aneurism treated by ligatures or compression exhibited this laminated fibrine, and then went on to a cure. It has been set down that that is a mode of cure. We know, on the contrary, many aneurisms where this deposition took place, and in which we have yet reason to think that the only cure has been by the coagulation of the central portion of the blood within the laminated fibrine. We must not, however, take too partial a view of the subject; and we must admit that, in the treatment of aneurism by compression, we obtain the cure by one of two modes. In the slower cases, where there is perfect compression, you may have the cure by deposition of the laminated fibrine which has commenced before the initiation of the treatment, and has been afterwards completed; and, secondly, where there is complete compression of the artery you may have it by coagulation of blood in the sac. I remember Dr. Mapother's case, and I expressed my views as to the carrying out of compression and completely arresting the current, and I observed great gratification on the part of that very intelligent surgeon that the result was what it was. The idea of any treatment of aneurism by complete compression where fibrine is deposited is altogether absurd; for I regard it as one of the most remarkable features of Dr. Mapother's case that there was there observed, after the pulsation had ceased, a fluid tract on the surface of the aneurism, clearly showing that there is a separation of the blood into coagulum and serum, and this fluid tract afterwards disappeared. Again, the sudden pain occurring when the pulsation is completely arrested by compression, proves the effect of the coagulation; it proves that the pain depends upon the enlargement of the volume of blood when the coagulation takes place. Therefore, the treatment, clearly established by numerous more recent cases, is to arrest completely the current in the sac. Whether that requires the use of the agent of chloroform or not is a matter of secondary consideration. But I was pleased to find that the doctrine—founded on the commonest rational principles more than twenty years ago—that the current should be arrested in the sac, is there adopted. In fact, you have there a complete analogy to the ligature; and, therefore, if you cannot bring the sides of the vessel together to arrest completely the current, you must expect the change which takes place, and which will be identical with that which takes place after the application of the ligature. Dr. Mapother made a remark as to the application of pressure below the aneurism. I conceive that there has not been any fact brought forward to establish that proposition. In the first place, we know that when a ligature is applied to a vessel in that way, the lateral circulation sends the blood into the vessel below, and that the blood has as much access to the lower part of the aneurism as in a case of compression. And we know further, as most persons have observed, that after a ligature has been applied pulsation sometimes returns in an aneurism, but that that does not in the least prevent the cure of it. Therefore, I think that Dr. O'Ferrall's view must be looked on as not substantiated by any fact. Lastly, with regard to the accessory proceedings, the methods employed in conjunction with compression, namely, the restriction of the patient's

diet, I am willing to admit that the use of a good diet may be desirable in contradistinction to old and opposite methods; but as to the diet influencing the condition of the aneurism by withholding the fluid, it is totally contrary to the principles of physiology. I have heard of cases in which patients tried it for a while and then got tired of it; and while the surgeon believed that his order was being carried out to the full, the patient was drinking *ad libitum*.

Mr. MEADE: I would only make one or two remarks on the two cases that Dr. Murray relates. Though the cure followed almost immediately in the cases of complete compression, yet I want to know, had not these cases been previously subjected to the older and more gradual form of treatment? I ask this question, because I have an idea that a great many of the cases in which the cure seemed to take place all at once, had been previously treated by gradual or occasional compression. I met with a case of that sort myself not many months ago. The man had been under care as a private patient in town, and we had been compressing the vessel in the old way adopted in cases of popliteal aneurism, but had not succeeded in curing it. When he came to the Bradford Infirmary, I found that the popliteal tumour had evidently a good deal of coagulum or fibrine, perfectly consolidated, and still the current was going on through it. I was not aware of the principle of immediate and total pressure; but still pressure was applied by means of a tourniquet, and the pulsation stopped almost immediately, or in a few minutes afterwards. But I did not in that case put the cure down to the total compression I used, but considered it as partly a sequence of the treatment that had been used before he came under my care. It seems reasonable to suppose that the blood will be in a more favourable state for coagulating if the interior of the sac have become rough, or partly lined with laminated fibrine, which roughens the interior, and therefore tends to make the blood coagulate. Coagulation may be the last step in the process; but has it often been found to occur where total compression has been the first and only treatment employed?

Mr. M. COLLIS: I am requested by the President to mention that, in his case of popliteal aneurism, digital compression effected a cure in twenty-three hours, and there had been no previous compression. No doubt, in most of the cases of rapid cure there had been previous efforts at compression.

Dr. MOORE: If the aneurism be filled with this clot and a cure be thereby effected, what amount of care and quiet is necessary afterwards? It has happened to me to obtain a cure of popliteal aneurism by digital compression, after a long failure with the tourniquet; and on the following morning, say fourteen hours after an absolute cessation of pulsation in the sac, the pulsation began again, and that without any movement on the part of the patient, which would have led me to suppose that there had been a dislodgement of the clot, from the opening of the artery into the aneurism, or some other mere mechanical action. What amount of care, what time of rest was necessary after the cessation of pulsation in the aneurism which Dr. Murray cured, it having been fed by the abdominal aorta? I should further like to remark that there are certain arteries which cannot be compressed so as to cure an aneurism, because of the intermediate vessels between the point of compression and the sac; and of all arteries I think the common femoral is the one most convenient for compression, and for most certainly cutting off the largest amount of blood from the sac. I suppose there is no other place in the whole arterial system, except the end of the axillary, at which one can be so sure of arresting the whole circulation, as at the femoral artery. I do not know whether or not I shall have to give

up the idea after the remarkable facts which have been brought forward to day, but I think that in some cases it must be absolutely essential to employ compression on two places, so as to cut off the possibility of the aneurism being fed by the second vessel.

Dr. MAPOTHER: Both my cases were previously treated for a few days by the instrumental and digital compression, which failed. In one of the cases, after thirty-six hours, the first clot gave way, having been probably formed by the plugging of the first vessel, and not by the filling of the sac with coagulum. Both of my cases required between three and four weeks of care and rest; and, after that, absorption rapidly went on.

Dr. MURRAY: I must express the great gratification I feel at finding the views which my cases have suggested to my own mind, so ably substantiated by Dr. Mapother and the various gentlemen associated with us to-day. These cases of aneurism suggest an almost infinite field of thought, speculation, and theorising, into which it is impossible for me to go. I rise, therefore, simply to insist on the points laid down in my papers, and to answer the questions which have been put. I insist, first, on the administration of chloroform in all these cases to destroy consciousness and to relax muscles. Absolute unconsciousness is necessary. In the next place, you must have the artery not only commanded so as to prevent visible pulsation, but you must have every single jet of blood that could possibly pass into the aneurismal sac stopped. If a single drachm of blood enter after the proper moment, the operation of coagulation will be interfered with. I absolutely insist on that point as to the immobility of the blood in the sac. It is impossible for me to go into the proofs that the cure takes place by the coagulation itself, and not by the deposition of fibrine; but the questions which have been put to me may be answered in this way. In the first case, the aneurism had only been pressed for two hours on a previous occasion, and that treatment was given up at that time chiefly because we feared to persevere much longer with chloroform. Gaining confidence from that, I tried four hours pressing on the aorta, as well as I could, preventing any great amount of blood from entering the sac. At the end of that time I was convinced that I could not command the aorta, and that I might go on for ever pressing the abdominal aorta without arresting the current of blood to it. It was then that I found I had not got at the process by which the artery was to be compressed. I determined to make another effort. This I did, and the aneurism was cured. In the other case, the artery was pressed for ten hours, and the man fainted. On his recovering, the aneurism seemed to be expanding; there was throbbing in the sac as before, and not the slightest evidence of consolidation. The patient seemed as bad as ever, and in danger of being left without being cured. But on applying the tourniquet, after about twenty minutes, not a particle of blood could enter the aneurismal sac, the aneurism ceased to beat, and was cured by the coagulation of the blood. With regard to the time necessary for rest, these two cases are interesting, as showing what a remarkably short time was necessary. In the first case, the patient was walking along the street with the aorta completely blocked up at the end of six days. He went out without my sanction, and walked a quarter of a mile home, although he felt rather tight about the waist, and his legs were a little numb, and when he reached home he had a slight pain in his back; and from that time he got on perfectly well, and was afterwards able to earn his bread by working as a paviour, as he did before the aneurism. In the next case, the man was making baskets in about four days after pressure, and since then he has followed his trade of a basket-maker.
